



NOTES TOGAVIRUSES

MICROBE OVERVIEW

- Pathogenic viruses in *Togaviridae* family
- **Capsid symmetry:** icosahedral
- **RNA structure:** linear, positive polarity

EASTERN EQUINE ENCEPHALITIS VIRUS (EEEV)

osms.it/eastern-equine-encephalitis

PATHOLOGY & CAUSES

- Highly pathogenic; causes central nervous system illness in humans, horses (equines)
- **Genus:** *Alphavirus*
- Spherical, approx. 69nm diameter (including glycoprotein spikes)
- **Enveloped, single-stranded, positive-sense RNA genome**
- Glycoproteins associated with neurovirulence, cellular apoptosis
- Potential bioterrorism agent use (aerosol route)
- Range
 - Atlantic, Gulf-coast states in eastern USA
- Four lineages
 - **Group I:** endemic in North America, Caribbean (causes most human disease)
 - **Groups IIA, IIB, III:** primarily cause equine illness in Central, South America
- **Viral life-cycle:** wild birds, *Culiseta melanura* mosquito (enzootic vector)
 - *C. melanura* rarely bites humans
 - Human transmission requires other mosquito species (e.g. *Aedes*,

Coquillettidia, *Culex*) to bridge between infected birds, humans

- Infected mosquito bite → 4–10 day incubation period → prodromal period → neurological symptom development occurs rarely

RISK FACTORS

- Rural residence; living in/visiting woodland habitats, swampy areas
- Outdoor occupation/recreational activity

COMPLICATIONS

- Encephalitis; cerebral edema; coma; residual brain damage (mild–severe, esp. young children); death (some)

SIGNS & SYMPTOMS

- May be asymptomatic
- **Prodromal period:** high fever, headache, nausea, vomiting
- **Neurologic presentation:** cranial nerve palsy, seizure, stupor → coma
- **Infants:** fever, bulging fontanel, generalized flaccid/spastic paralysis

VISIT...

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DIAGNOSIS

DIAGNOSTIC IMAGING

MRI

- Focal lesions in basal ganglia, thalamus, brainstem

LAB RESULTS

- Leukocytosis; left shift
- Hyponatremia
- Serology
 - IgM antibody presence
- Cerebrospinal fluid (CSF) examination
- Lymphocytic pleocytosis, ↑ neutrophils; ↑ protein; IgM antibodies (assay); virus isolation

OTHER DIAGNOSTICS

Electroencephalography (EEG)

- Generalized slowing; disorganized pattern

TREATMENT

- No specific treatment

MEDICATIONS

- **Supportive:** anticonvulsants, corticosteroids (↓ inflammation)

OTHER INTERVENTIONS

- **Supportive:** IV fluid, respiratory support, monitor intracranial pressure
- Prevention
 - Insect repellent (DEET, picaridin, IR3535, oil of lemon eucalyptus)
 - Protective clothing
 - Vector control

RUBELLA VIRUS

osms.it/rubella-virus

PATHOLOGY & CAUSES

- Highly communicable virus → German measles
- **Enveloped, positive-sense, single-stranded RNA virus**
- **Family:** *Togaviridae*
- **Genus:** *Rubivirus*
- Three structural proteins
 - C: capsid protein surrounding virion RNA
 - E1, E2: glycosylated proteins forming transmembrane antigenic sites
- Humans are the only natural hosts
- **Transmission:** droplet inhalation/direct contact with infectious nasopharyngeal secretion
- Viral contact → 12–23 day incubation → nasopharyngeal cell, regional lymph

node viral replication → viremia → maculopapular rash eruption → rash resolution (approx. two days)

- Contagious via virus shedding before, after rash appears
- ↑ contagiousness during rash eruption
- Spreads transplacentally

RISK FACTORS

- Unvaccinated
- Travel (especially abroad)
- Contact with febrile rash individuals

COMPLICATIONS

- Thrombocytopenic purpura
- Encephalitis (rare)
- If infected during pregnancy: congenital rubella syndrome (CRS)

- ↑ risk of miscarriage, fetal death, stillbirth
- **CRS: A ToRCHeS** (see mnemonic) infection; ↑ first trimester risk; extramedullary hematopoiesis ("blueberry muffin" rash), cataract, heart defect, hearing impairment, intellectual disability



MNEMONIC: ToRCHeS

Perinatal infections passed from mother to child

Toxoplasmosis, *Toxoplasma gondii*

Other infections

Rubella

Cytomegalovirus

Herpes Simplex virus-2/
neonatal herpes simplex

SIGNS & SYMPTOMS

- **Maculopapular rash**
 - **Pink/light red macules:** coalesce to form evenly-colored desquamating rash
 - **Initially:** face → **generalized** rash within 24 hours
 - **Duration:** three days
- **Lymphadenopathy;** primarily posterior auricular/suboccipital lymph
- Low-grade **fever**
- Mild nonexudative conjunctivitis
- Forchheimer spots on soft palate
- **Arthralgias**
- Orchitis
- Asymptomatic (half of cases)

DIAGNOSIS

LAB RESULTS

- Polymerase chain reaction (PCR) testing/molecular typing
 - Throat, nasal, urine specimens
- Serologic testing
 - Enzyme immunoassay (EIA) detects rubella-specific IgM antibodies
- Pregnancy

- Reverse transcription-PCR (rubella virus RNA performed on amniotic fluid)

OTHER DIAGNOSTICS

- Clinical diagnosis
- High suspicion index
 - Febrile rash, unvaccinated status

TREATMENT

- No specific antiviral therapy

OTHER INTERVENTIONS

- Infection control measures
 - Prompt isolation for seven days after rash development
- **Vaccine:** live-attenuated measles-mumps-rubella (MMR)/measles-mumps-rubella-varicella (MMRV)
 - **First dose:** 12–15 months old
 - **Second dose:** 4–6 years old



Figure 101.1 A child with rubella showing a characteristic maculopapular, erythematous rash.

WESTERN EQUINE ENCEPHALITIS VIRUS (WEE)

osms.it/western-equine-encephalitis

PATHOLOGY & CAUSES

- Causes central nervous system illness in humans, horses (equines)
- Genus *Alphavirus*
- Spherical, approx. 69nm diameter (including glycoprotein spikes)
- Enveloped, single-stranded, positive-sense RNA genome
- Contain glycoproteins associated with neurovirulence, cellular apoptosis
- **Range:** most commonly US states, Canadian provinces west of Mississippi River
- **Virus life-cycle:** wild birds, other vertebrates, *Culex tarsalis* mosquito (enzootic vector)
 - *Culex tarsalis* (another human vector)
- Potential bioterrorism agent use (aerosol route)
- Infected mosquito bite → 2–10 day incubation period → sudden onset of severe headache, fever/chills, dizziness, chills, myalgias, malaise, tremor, irritability, photophobia, neck stiffness → rapid neurological manifestation development → recovery
 - **Most adults:** no residual neurological effects
 - **Infants, children:** ↑ long-term neurologic sequelae risk

RISK FACTORS

- Most cases June–September
- Bimodal age pattern: < one year; ↑ risk in elderly
- Biologically-female
- Rural residence
- Outdoor occupation/recreational activity

COMPLICATIONS

- Encephalitis, coma, respiratory failure, death
- **Infants:** intellectual disability, cerebellar damage, spastic paralysis, developmental delay

SIGNS & SYMPTOMS

- Neurological manifestations
 - Generalized weakness; somnolence; hand, tongue, lip tremor; cranial nerve palsy; motor weakness; ↓ deep tendon reflexes
- **Infants:** poor feeding, fussiness, fever, vomiting, tense/bulging fontanelle

DIAGNOSIS

LAB RESULTS

- Serology
 - **Enzyme-linked immunosorbent assay (ELISA):** IgM antibodies
 - Hemagglutination-inhibition, neutralizing antibody presence
- CSF
 - **ELISA:** IgM antibodies
 - Lymphocytic pleocytosis
 - ↑ protein

TREATMENT

- No specific treatment

MEDICATIONS

- **Supportive:** anticonvulsants, corticosteroids

OTHER INTERVENTIONS

Prevention

- Insect repellent (DEET, picaridin, IR3535, oil of lemon eucalyptus)
- Protective clothing
- Vector control